ELSEVIER

CrossMark

Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 15 (2014) 1316 – 1323

Procedia Economics and Finance

www.elsevier.com/locate/procedia

Emerging Markets Queries In Finance And Business

Sustainable development between recent experiences and future challenges

Mara Ursache[a,]*

[a]Centre for European Studies, Alexandru Ioan Cuza University of Iasi, Carol I Bulevard, Nr. 19, Iasi - 700507, RO

Abstract

The concept of sustainable development demands countries all over the world to use their natural resources rationally while aiming their economic development, and at the same time to take into account the quality of environment as a determinant of their societies welfare. The purpose of this study is to investigate the influence in time and space of the variable resource productivity on economic development (using GDP indicator). To examine this linkage, the paper applies a cross time cross section method of the 27 European members over the period 2000 – 2009.

Based on the result obtained, the author shall try to trace, in the conclusion, a few guiding lines which could be of strategic importance for stimulating action and awareness that the efficient use of natural resources can create a high degree of welfare and that the complex and dynamic relationship between environmental quality and economic development must be a contemporary concern.

Selection and peer-review under responsibility of the Emerging Markets Queries in Finance and Business local organization

Keywords: sustainable development; resource productivity; economic growth; EU;

* Corresponding author. Tel.:+4-0749-829-227.
*E-mail address:*maraursache@yahoo.com.

Selection and peer-review under responsibility of the Emerging Markets Queries in Finance and Business local organization
doi:10.1016/S2212-5671(14)00594-2

1. Sustainable development – beyond development as usual

The most serious problems we face today come out from the interaction of two highly complex systems – the human system and the ecological system that supports it.

The natural environment plays an important role in contemporary societies. It is the basic factor to continue human survival and long-term prosperity of mankind is unthinkable if we are not able to ensure that future generations can enjoy the full benefits of nature. At the same time, development is needed to tackle poverty in developing countries and to empower people everywhere to live in a civilized manner in a more favorable environment.

A growing number of scientific facts and data suggests that, globally, the scale of economic activity upsets ecosystem performances and services (Borucki et al., 2013; Daly and Farley, 2004; Ehrlich and Ehrlich 2013; Lenton et al., 2008; Milesi et al., 2005; Rockström et al., 2009, Running, 2012; Tedesco and Monaghan, 2009; Vitousek et al., 1997). The main accusation on the current economic philosophy is its predominant quantitative side, because in its vision natural resources and the environment have been treated as mere tools in the service of growth and environmental degradation and damage to human health have not been taken into account (Pohoata, 2003).

The economic system works with material flows, energy and environmental services offered by the ecological system that includes the first. Moreover the economic system inevitably depends on the availability of inputs (resources) and on the ecosystem ability to assimilate waste (Daly 1991, Daly 1999, Daly and Farley, 2004).

Volume of waste products affect the assimilative capacity of the biosphere (Gruber and Galloway, 2008; Tedesco and Monaghan, 2009). Natural capital (both renewable and non-renewable sources) is exhausted at increasing levels that threaten its future use (Foley et al., 2005; Trembley-Boyer et al., 2011; Worm, 2006). The high rate of use in some cases, upset larger ecological systems, systems on which ultimately depends the survival of mankind (Barnosky, 2012; Ehrlich and Ehrlich 2013; Rockström et al., 2009, Thomas et al., 2004). The consequences are global, potentially irreversible and will certainly affect more people.

Therefore the present society needs profound changes in thinking, in economic and social constructions and in consumption and production designs, because trying to build a sustainable growth pathway, in which economic and social progress will continue not only for present but also for future generations, remains the biggest challenge of the century. Furthermore, sustainable consumption and production designs are crucial to confront climate change. Decreases in energy consumption are associated to the diminution of CO_2 emissions.

Sustainable development is one of the most significant theory in the social sciences and it is increasingly recognized as an alternative path that can grant low-carbon and climate-resilient development, substantial improve resource efficiency, healthy and more resilient ecosystems, social inclusion and greater economic opportunities and social justice particularly for the poor who depend strongly on the environment for their livelihoods, healthiness and well-being. Sustainability regards that economic evolution must be wholly integrated to the environment. Economic growth has been proven to be not sustainable without social and environmental input.

The concept of sustainable development should be differentiated from that of sustainability. "Sustainability" is the ability of a system, in which it is maintained in a particular state over time. The concept of sustainable development refers to a process that involves changes and development. It aims to achieve continuous improvement of quality of life, and the emphasis is therefore on supporting the improvement of human welfare. Therefore sustainable development is less a search for a stable equilibrium but rather a dynamic concept which recognizes that change is inherent in human societies.

Sustainable development is a major and essential objective of the European Union, seeking to continuously perfect the quality of life and wellfare for present and future generations, by bringing together economic development, protection of the environment and social justice. Therefore sustainable development cannot be isolated from the European member states policies and practices.

2. Statistical Approach

2.1 Data and variables

The study focuses on the investigation of the influence in time and space of the variable *resource productivity* on economic development.

In this paper, for the measurement of economic growth, we use the Gross Domestic Product (GDP) expressed in purchasing power standards (PPS) over Domestic Material Consumption (DMC) for each country. The motivation of this approach is twofold.

Firstly, the GDP is an aggregate indicator which encapsulates the activity in every sector, smoothing out specific shocks.

Secondly, according to Eurostat if comparisons of resource productivity between countries are made then the GDP_PPS/DMC should be used. DMC measures in tones the amount of materials directly used by a national economy and is an aggregate composed of domestic extraction plus all physical imports minus all physical exports. Also using the GDP_PPS/DMC indicator is equivalent to a differentiation of the original GDP series, thus increasing the probability of producting a stationary series, a necessary condition in panel data analysis.

The other variable under study, the resource productivity, is chosen because, it is relevant in two ways. First of all, the indicator refers to the technological level, the intensity with which raw materials are transformed and are given value. Second, it targets sustainable development, conservation and effective management of the available resources of a country and environmental protection in terms of economic growth.

The panel includes the 27 European members. The data was retrieved from the Eurostat database. The time span is from 2000 until 2010, a choice dictated by the availability of data.

The statistical software used was EViews 7.0 and Microsoft Excel 2007.

2.2 Econometric model and Methodology

In order to assess the influence of the resource productivity on economic growth, we will employ a panel data analysis.

The proposed model is:

$$GDP\_PPS_{i,t} = a_0 + a_1 Resource\_Productivity + \varepsilon_{t,i} \qquad (1)$$

Equation (1) is subject to panel analysis, accounting for no/fixed/random effects concerning cross-section and period, thus leading to five possible models (no effects; fixed/fixed; random/fixed; fixed/random; random/random) from which to choose the most relevant.

The validation of a certain model requires the completion of the following steps:

1. Stationarity check of the time series used in the model (to determine the possibility of co-integration);
2. Panel data analysis with fixed/random effects.

Stationarity check (Panel unit root tests)

For this research paper we have selected the Im, Pesaran and Shin test (IPS), in support of the presence of unit roots in panels. The IPS test has its base on the acknowledged Dickey-Fuller method and brings together information from the time series dimension with that from the cross section dimension, so that only in a small number of cases observations are required for the test to have power. Given that the IPS has been shown to have superior test power by researchers in economics in analyzing long-run relationships in panel data, we will also employ this method in our survey.

Panel analysis with fixed/random effects

We employed the panel data estimation in the research to comprise the dynamic behavior of the parameters and to deliver more efficient estimation and information of the parameters. The panel data techniques are used because of their superiority over cross-section and time series in using correlations in the information available, which are not detectable in cross-sections or in time series alone (Baltagi and Kao, 2000). Panel data sets posses several major advantages (Hsiao, 1986; Baltagi, 1995). Panel data propose individual heterogeneity to reduce the risk of attaining biased results and provide a considerable number of data points (observations) to increase the degrees of freedom and variability and to be able to analyse the dynamics of adjustment. The Panel data model comprises three different procedures:

- Fixed effects procedure

The Fixed effects procedure considers the constant as being part of a certain group, therefore (section) – specific, i.e. it allows for distinct constants for each group (section). The Fixed effects are also named the Least Squares Dummy Variables (LSDV) estimators. The fixed effects panel model can be written as:

$$y_{i.t} = \alpha + \beta x_{i,t} + \mu_i + \nu_{i,t} \tag{2}$$

where μ_i and $\nu_{i,t}$ represent the decomposition of disturbance term; μ_i symbolizes the individual specific effect and $\nu_{i,t}$ is the 'remainder disturbance', which varies over time and entities (capturing the whole random behaviour of $y_{i.t}$).

- Random effects procedure

The Random effects procedure is an alternative method of estimation that handles the constants for each section as random parameters rather than fixed. The intercepts for each cross-sectional unit are assumed to arise from a common intercept α (which is similar for all cross-sectional units and over time), plus a random variable ϵ_i that varies cross-sectionally but is constant over time. ϵ_i measures the random deviation of each entity's intercept term from the 'global' intercept term α. The model for random effects procedure is:

$$y_{i.t} = \alpha + \beta x_{i,t} + \omega_{i,t}, \text{ where } \omega_{i,t} = \epsilon_i + \nu_{i,t} \tag{3}$$

In this model, $x_{i,t}$ represents a 1 * k vector of explanatory variables, but contrasting the fixed effects model, there are no dummy variables to capture the variation (heterogeneity) in the cross-sectional dimension. Conversely, this occurs via the ϵ_i terms. The parameters (α and the β vector) are estimated consistently, but instead of OLS, Generalized Least Square method (GLS) is employed

3. Discussion of results and findings

3.1 Stationarity of the series

A time series is stationary when its statistical properties such as mean, variance, autocorrelation, etc. are constant over time (Jaba, 2003). As previously stated, a useful test in this regard is the Im, Peseran, Shin (2003) (IPS), based on ADF, but adapted to panel data. The results of the unit root test are presented in Table 1.

Table 1 – IPS panel unit root test result

Variable	IPS panel unit root test result (Level) Null: Unit root (assumes individual unit root process)
GDP_PPS	-4.89306 (0.0000)***
Resource_Productivity	1.56332 (0.9410)***
P-values are in parentheses. *** shows significance at 1%	

Source: own processing in EViews 7.0

The results show that the hypothesis that the GDP_PPS series contain a unit root can be rejected, thus the series are stationary and in the case of resource productivity series, the value 0.09410 > 0.5 shows that the series aren't stationary so we apply a differention of first order. After we use a differention of first order we obtain a value of -6.67743/ 0.0000*** <0.5 thus the series are stationary.

3.2 Equations estimation

We further proceed to the estimation of the parameters and their significance for each of the proposed models by resorting to Least Squares (LS). In Table 2, the effects of Resource_Productivity on the annual GDP_PPS are depicted.

The estimation with no effects has the model

$$GDP\_PPS_{i,t} = \alpha_0 + \alpha_1 Resource\_Productivity + \varepsilon_{i,t},$$

While the equation involving fixed effects is

$$GDP\_PPS_{i,t} = \alpha_0 + \alpha_1 Resource\_Productivity + \mu_i + \nu_{i,t}$$

Furthermore, the equation with random effects is

$$GDP\_PPS_{i,t} = \alpha_0 + \alpha_1 Resource\_Productivity + \omega_{i,t}, \text{ where } \omega_{i,t} = \epsilon_i + \nu_{i,t}$$

Table 2 – Equation parameters estimations

Variable	No effects	Fixed/Fixed	Fixed(country) Random(year)	Random(country) Fixed(year)	Random/Random
Resource_Productivity	97.99013	-1.148911	-0.968157	-1.086380	-0.906164
c	-4.770822	96.75337	96.74847	96.75168	96.74679
		0.0000	0.0000	0.0000	0.0000
R^2		**0.989655**	**0.989214**	0.136679	0.001134

Source: own processing in EViews 7.0

Although all the p-values are significant for all models, the R^2 of the models point out that only the Fixed/Fixed respectively Fixed(country)/ Random(year) models are appropriate. A choice between the two is made by using the Hausman test (1978), which compares a more efficient but volatile model against a less efficient but robust one, to certify that the results are consistent.

Table 3 – Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. D.f	Prob.
Cross-section random	1.545739	1	0.2138

Source: own processing in EViews 7.0

With a confidence level of 5%, as the p-value indicates, the null hypothesis is accepted, thus we conclude that the Fixed(country)/Random(year) effects model is both consistent and more efficient and it shall be used detrimental to the Fixed/Fixed model.

This model implies that while the economic conditions are generally different in one year for all the European countries, it is the characteristics of a certain country which leads the resource productivity to influence the GDP.

Hence, the chosen equation is

$GDP\_PPS_{i,t} = \alpha_0 + \alpha_1 Resource\_Productivity + \omega_{i,t}$ $\omega_{i,t} = \epsilon_i + \nu_{i,t}$, where ϵ_i (cross – sectional effect) and $\nu_{i,t}$ (period effect) are available on demand

The study shows that beginning from the year 2000, the member states' resource productivity developed rather differently. As a reference, according to Eurostat, in the analysed period 2000-2009, the aggregated Eu-27 economy increased resource productivity by around 17%. European States performing considerable above Eu average include the Czech Republic, Latvia, the Netherlands, Luxembourg and the United Kingdom. Countries where resource productivity decreased are Romania, Cyprus, Estonia, Ireland and Portugal.

The development courses for the period 2000-2009 are more heterogeneous for those countries who joined the EU after 2004. From our calculations, it appears that Romania records the lowest value (-40%), aspect which reveals a weak point of maximum importance, namely the negative trend in the use of available raw materials.

Apart from Romania, only Estonia is still in the territory of negative evolutions, but it is far from the 40% rebound in our country. The huge setback suffered by Romania might be explained by its communist past from which it inherited inefficient resource management and consumption patterns based more on quantity than on quality. Obsolete technologies, lack of concern from authorities and society and of environmental infrastructure and the high cost of correcting these shortcomings may also explain Romania's present situation of resource productivity.

On the other hand, starting its economic performance from a level situated at half of Romania's performance, Bulgaria passed Romania, improving performance by 30%. At the opposite pole we find Latvia, with an impressive increase in resource efficiency (56%) which brings it to the first position, and the Czech Republic, with an advance of 40%. The other member states developed in a more narrow range between -4 (Ireland) and +41 (the Netherlands).

The economic crisis in 2009 had a greater impact and disturbed the material-intensive industries of manufacturing and construction much more than the services industries. The DMC declined by more than 11% between 2008 and 2009, i.e. falling much more than GDP.

A resource efficient Europe is one of the central objectives of the Europe 2020 strategy aiming at a shift towards a resource-efficient, low-carbon economy for achieving sustainable growth.

Setting up a resource efficient economy is fundamental to green growth. It involves implementing policies to improve resource productivity and sustainably manage natural resources and materials. To be successful such policies must be founded on a good knowledge support of the material basis of the economy, international and national material flows, and the aspects that lead to changes in natural resource use and material productivity over time, across the nations and in the different sectors of the economy.

4. Concluding remarks

The notion of sustainable development refers to a practice that involves changes or development. The strategy aims to achieve a continuous improvement in quality of life and the emphasis is therefore on supporting the improvement of life quality. Therefore sustainable development is less a search for a stable equilibrium but rather a dynamic concept which recognizes that change is inevitable in human societies.

The European member states require ambitious policies to stimulate an important increase in resource productivity and efficiency, through technical change and innovation.

As stated in the study several connections exist between resource productivity and environmental degradation as well as public health.

Thus, policy makers should pay attention to resource allocation and efficiency of any of their use, stimulating economic environment, and social progress. Resource productivity is a way of expressing performance and economic efficiency. A competitive economy is an economy capable of generating economic growth and high efficiency on long term within a sustainable framework.

Progress is a natural purpose of each national economy. The achievement of social progress is based on a decisive factor, that is the efficiency of use of natural, human and financial resources the considered economy is dependent on. An intensive sustainable economic growth, a goal to be touched by any modern society, creating an advanced economy and a high degree of welfare for the population can be achieved only through the effort of human factor to use in a productive way each unit of natural, human and financial resource.

Accessing a correct way towards an intelligent durable development path in a globalised world requires combining economic, social and environmental elements in a well balanced design called sustainable development.

References

Baltagi, B.H. 1995, Econometric Analysis of Panel Data, New York: Wiley.

Baltagi, B.H. and Kao. 2000, Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey, mimeo.

Barnosky, A., Hadly, E., Bascompte, J., Berlow, E., Brown, J., Fortelius, M., Smith, A. 2012, Approaching a state shift in Earth's biosphere, *Nature*, Vol. 489, pp. 52-58.

Daly, H., and Farley, J. 2004, Ecological Economics: Principles and Applications. Island Press, Washington.

Daly, H. 1991, Steady State Economics. Island Press, Washington.

Daly, H. 1999, Ecological economics and the ecology of economics. Edward Elgar, Cheltenham.

Ehrlich, P., Ehrlich, A. 2013, Can a collapse of global civilization be avoided?, Proceedings of the Royal Society B, 280, 20122845.

Foley, J.A., DeFries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, S.R., Chapin, F.S., Coe, M.T., Daily, G.C., Gibbs, H.K., Helkowski, J.H., Holloway, T., Howard, E.A., Kucharik, C.J., Monfreda, C., Patz, J.A., Prentice, I.C., Ramankutty, N., Snyder, P.K. 2005, Global Consequences of Land Use, Vol. 309, No. 5734, pp. 570-574.

Gruber, N., Galloway, J. 2008, An earth-system perspective of the global nitrogen cycle, Nature, No. 451, pp. 293-296.

Hausman, J. A. 1978, Specification tests in econometrics, Econometrica, Vol. 46, Issue 6, pp.1251-1271.

Hsiao, C. 1986, *Analysis of Panel Data*, Cambridge: Cambridge University Press.

Jaba, E. 2003, *Statistica* (3rd ed.), Ed. Economica, București.

Lenton, T., Held, H., Kriegler, E., Hall, J., Lucht, W., Schellnhuber, H. 2008, Tipping elements in the Earth's climate system., Proceedings of the National Academy of Sciences of the United States of America, No. 105
,pp. 1786-1793.

Milesi, C., Hashimoto, H., Running, S., Nemani, R. 2005, Climate variability, vegetation productivity and people at risk, Global and Planetary Change, No. 47, pp. 221-231.

Pohoață, I. 2003, Filosofia economică și politica dezvoltării durabile, Ed. Economică, București.

Rockstrom, J et al. 2009, A safe operating space for humanity. Nature 461:471-475.

Running, S. 2012, A measurable planetary boundary for the biosphere, *Science*, Vol. 337, pp. 1458-1459.

Vitousek, P., Mooney, H., Lubchenco, J., Melillo, J. 1997, Human domination of Earth's ecosystems. Science , No. 277, pp. 494–499.

Tedesco, M., Monaghan, A. 2009, An updated Antarctic melt record through 2009 and its linkages to high- latitude and tropical climate variability. Geophysical Research Letters, 36, L18502.

Thomas, C., Cameron, A., Green, R., Bakkenses, M., Beaumont, L., Williams, S. 2004, Extinction risk from climate change, *Nature*, Vol. 427, pp. 472-475.

Worm, B., Barbier, E., Beaumont, N., Duffy, J., Folke, C., Watson, R. 2006, Impacts of biodiversity loss on ocean ecosystem services, *Science*, Vol. 314, pp. 787-760.